Underbank Primary School Flood Risk Assessment

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1 Introduction

1.1 Purpose of Report

AECOM Ltd was commissioned in February 2014 by South Lanarkshire Council Property Services to undertake a Flood Risk Assessment (FRA) for the proposed Underbank Primary School, located on the west bank of the River Clyde, approximately 1km south east of Crossford.

A site specific flood risk assessment was undertaken in accordance with a Level 2 Assessment as outlined in CIRIA 624 – Development and Flood Risk, and with reference to Scottish Planning Policy (SPP) and SEPA Technical Flood Risk Guidance for Stakeholders.

A review of the flood inundation areas, general topography and overland flow paths has been carried out to determine the flood risk to the development from all flood sources. Recommendations are made to ensure that the development is appropriately flood resilient and resistant from all sources of flooding.

This includes analysis of the ground levels within the development and the access to the site to confirm that these are at least 1m above the design flood level of the flood zone in which the development is located. The effects of climate change have also been taken to in account with in this assessment.

1.2 Context

The flood risk assessment has been carried out to determine the flood risk to the site of the Underbank Primary School and allow these findings to be taken into account when developing the proposed new school. The assessment is based on guidance documents stated above.

In consideration of planning applications, planning authorities require to be satisfied that due account has been taken of Scottish Planning Policy, Planning Advice Note 69 (PAN69) and Planning and Building Standards Advice on Flooding. It is necessary to show that adequate protection against flooding exists or can be provided for the proposed development and that the development does not increase any existing flood risk to persons or property upstream and downstream. Flood risk has been categorised as High, Medium and Low based on the probability of inundation. The following extract from the Flood Risk Framework set out in SPP highlights the likely response to planning applications within these zones.

Little or no risk – Annual probability of watercourse, tidal or coastal flooding: less than 0.1% (1:1000).

- No constraints due to watercourse, tidal or coastal flooding.

Low to medium risk area – Annual probability of watercourse, tidal or coastal flooding: in the range 0.1% – 0.5% (1:1000 – 1:200)

- These areas will be suitable for most development. A flood risk assessment may be required at the upper end of the probability range (i.e. close to 0.5%) or where the nature of the development or local circumstances indicate heightened risk. Water resistant materials and construction may be required depending on the flood risk assessment. Subject to operational requirements, including response times, these areas are generally not suitable for essential civil infrastructure such as hospitals, fire stations, emergency depots etc. Where such infrastructure must be located in these areas or is being substantially extended it should be capable of remaining operational and accessible during extreme flood events

Medium to High Risk – annual probability of watercourse, tidal or coastal flooding greater than 0.5% (1:200)

- Generally not suitable for essential civil infrastructure such as hospitals, fire stations, emergency depots etc., schools, care homes, ground-based electrical and telecommunications equipment unless subject to an appropriate long term flood risk management strategy. The policy for development on functional flood plains applies. Land raising may be acceptable.
- If built development is permitted, appropriate measures to manage flood risk will be required and the loss of flood

storage capacity mitigated to produce a neutral or better outcome.

- Within built up areas, medium to high risk areas may be suitable for residential, institutional, commercial and industrial development provided flood prevention measures to the appropriate standard already exist, are under construction or are planned as part of a long term development strategy. In allocating sites, preference should be given to those areas already defended to required standards. Water resistant materials and construction should be used where appropriate.
- In undeveloped and sparsely developed areas, medium to high risk areas are generally not suitable for additional development. Exceptions may arise if a location is essential for operational reasons, e.g. for navigation and water based recreation uses, agriculture, transport or some utilities infrastructure and an alternative lower risk location is not achievable. Such infrastructure should be designed and constructed to remain operational during floods. These areas may also be suitable for some recreation, sport, amenity and nature conservation uses provided adequate evacuation procedures are in place.
- Job-related accommodation (e.g. caretakers and operational staff) may be acceptable. New caravan and camping sites should not be located in these areas. If built development is permitted, measures to manage flood risk are likely to be required and the loss of flood storage capacity minimised. Water resistant materials and construction should be used where appropriate.

South Lanarkshire Council design criteria guidance note for Sustainable drainage Systems (SuDS) makes reference to CIRIA 624 and the Reporting Requirements for flood risk assessments as issued by SEPA. In addition the document provides guidance to the appropriate standard of protection and freeboard based on flooding from storm water attenuation. The same standard can however been related to fluvial flooding from watercourses.

- It should be noted that if flooding is to occur within the application site under the 1 in 200 year (plus 20% uplift for the predicted effects of climate change) post development critical storm condition then the **finished floor levels** of dwellings adjacent to the flooded area(s) must be a minimum **of 0.6m above the high water level or 1.0m above the high water level when the application site is adjacent to a watercourse.**

It has subsequently confirmed that for a flood risk assessment the critical scenario is the 1 in 200 year plus climate change and that a freeboard of 1m should be applied to the flood level in that event to determine the critical flood level.

1.3 Site Location

The proposed Underbank Primary School is situated off The A72 Lanark Road, 1km south east of Crossford in South Lanarkshire, National Grid Reference NS 83200 45750. The location and outline of the site is shown in **Figure 1.1** below. The site is currently occupied by glass houses attached to the nearby garden centre, which are to be demolished and a new building with outdoor play area facilities to be built in its stead, approximately 250m south east of the existing primary school site.

The site lies immediately adjacent to the River Clyde. Two minor watercourses drain the hillside to the south west of the site, and are culverted under the A72 road and remaining land discharging to the River Clyde to the north and south of the school.

An assessment has been carried out to determine flood risk at the site, and this report has been prepared to present the findings of the FRA.

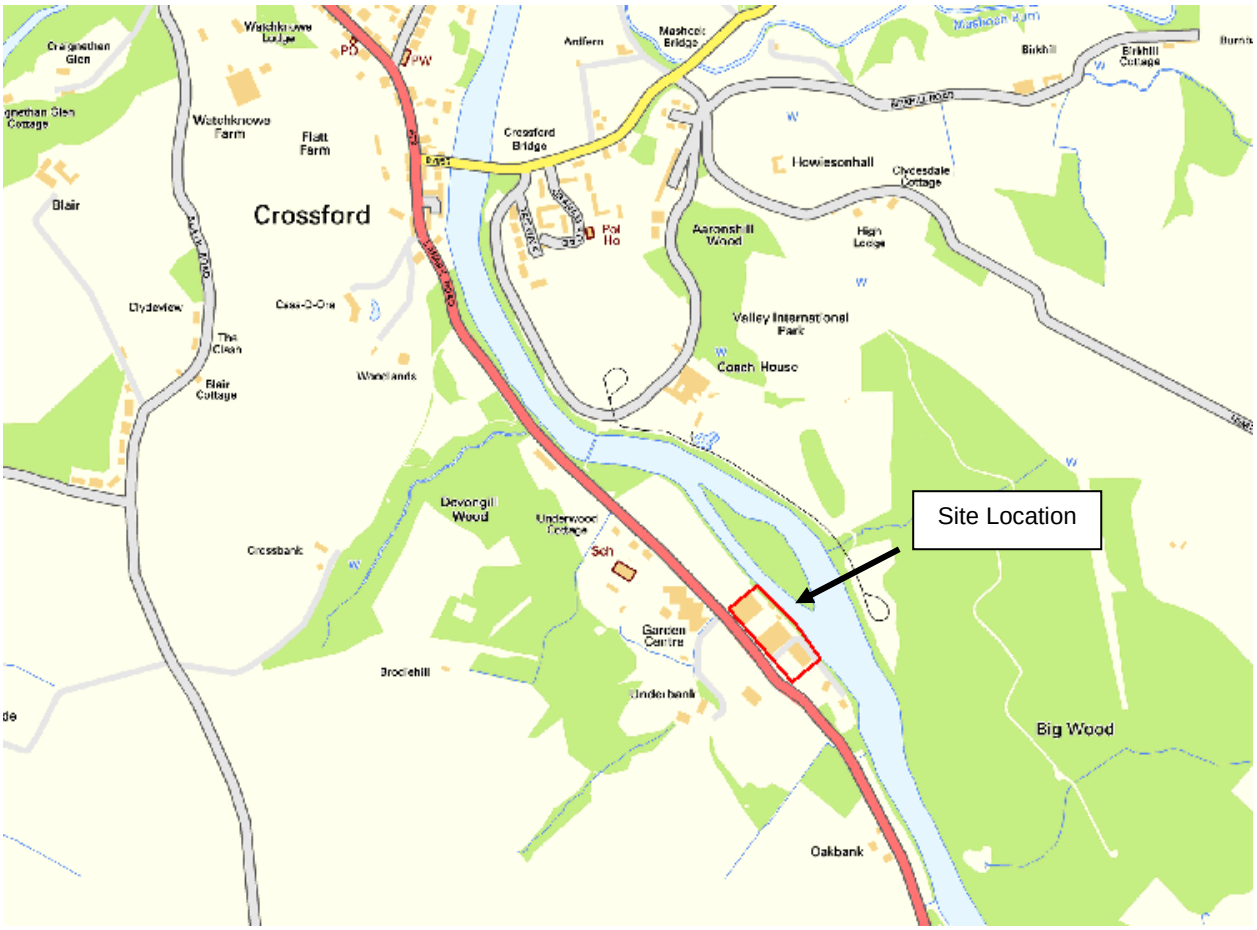

Figure 1.1 – Location Plan

1.4 SEPA Flood Map

The SEPA Flood Map provides an illustration of river flood plains; the relatively flat areas of land adjacent to rivers that are subject to periodic coverage by floodwater. The outline of the floodplains highlighted in the map identify the areas that in any year have a 1 in 200 (0.5% Annual Exceedance Probability (AEP)) of flooding from a river. The extents of the floodplains have been estimated using predictive computer modelling techniques that are commonly used as a decision support tool by flood defence authorities throughout the UK.

The maps also show the likelihood of flooding from surface water (pluvial).

As the predictive models cover the whole of Scotland there are clear limitations associated with the methodology and data used. These inevitably have an impact on the accuracy of the flood outlines. For that reason, the flood outlines should regarded as 'indicative' of the general areas that are estimated to be prone to flooding and are not suitable for determining the flood risk to a particular property or specific point location.

SEPA's flood map shows Underbank Primary School is in a low flood risk area for both fluvial and surface water flooding. SEPA's Flood Map is available for viewing at: http://www.sepa.org.uk/flooding/flood_extent_maps/view_the_map.aspx

2 Flood Risk Assessment

2.1 Flooding Mechanisms

2.1.1 Flooding from watercourses

The River Clyde flows from south east to north west immediately to the east of the proposed school. Fluvial flooding from the Clyde is therefore the major potential source of flooding to the site. This is discussed in more detail in section 2.3 below.

In addition, two small watercourses run south west to north east and are culverted under the A72 to discharge into the Clyde to the north and south of the site. Again, there is potential for flooding from these ditches should the culvert headwalls upstream of the A72 road be overtopped. This is also addressed in section 2.3 below.

2.1.2 Sewer flooding

Scottish Water sewer maps were reviewed with regard to assessing the risk of sewer flooding to the proposed development. There was no public sewer network found to be present in and around the site. It is assumed that a septic tank is therefore currently in place for the site. This being the case, the proposed development is therefore not at risk from sewer flooding.

2.1.3 Pluvial Flooding (flooding from land).

SEPA's surface water flood map indicates that the site is not at risk of surface water flooding. The site is located between the A72 and River Clyde. At its highest point, the site has an elevation of approximately 57mAOD close to the road, and falls fairly uniformly towards the river, with a lowest elevation at the northern most corner of approximately 53.2 mAOD (Figure 2.1).

On the other side of the road, a steep hillside rises to the south west. Runoff generated on this hillside has the potential to flow across the road and across the site towards the river. However there are currently no low lying areas within the site where surface water or rainfall is likely to pond to any depth. Provided the surface water strategy accounts for runoff from the hillside to the south west, and the proposed landform allows excess surface water exceeding the design capacity to shed from the site, no localised flooding from surface water will occur.

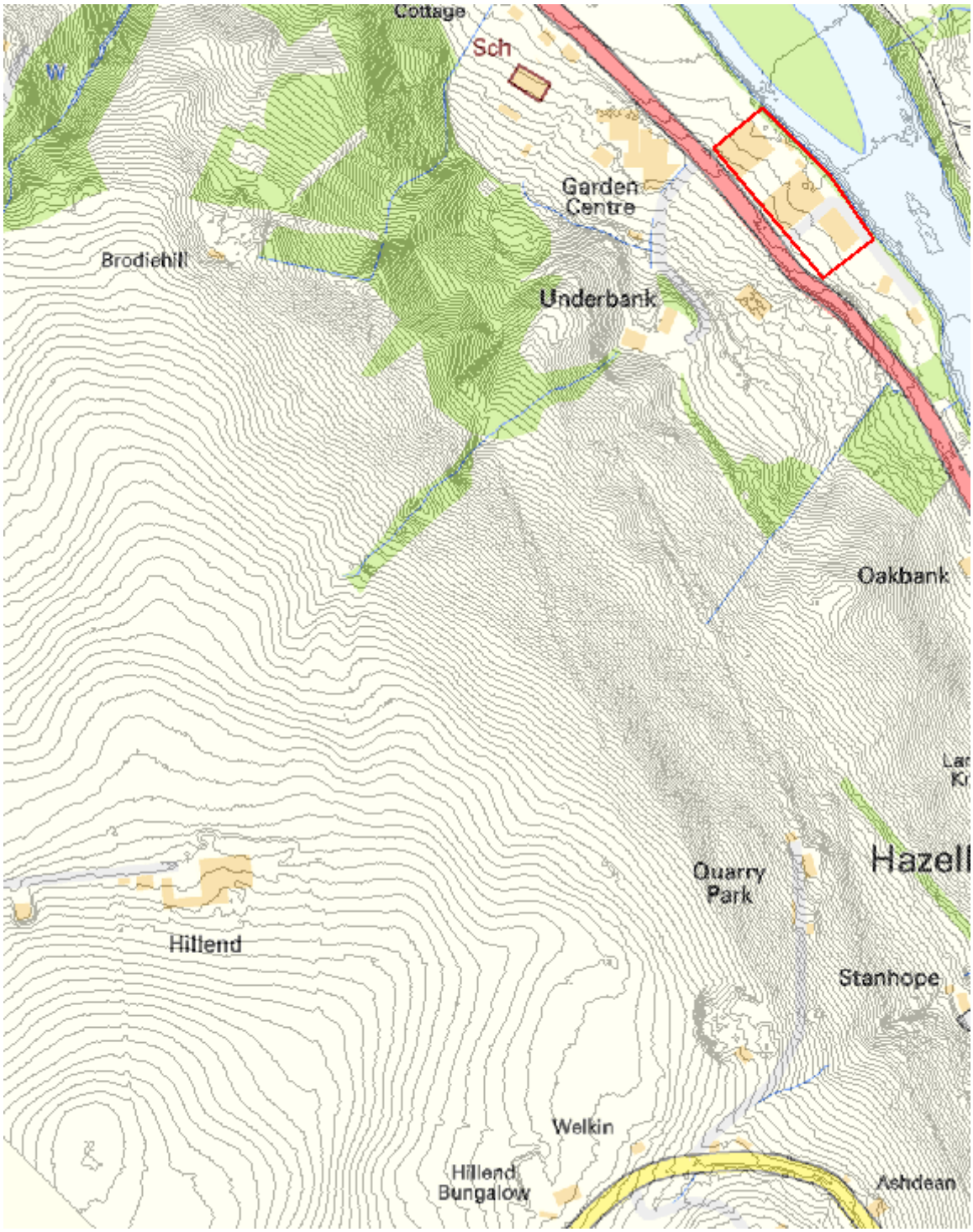

Figure 2.1: 1m contours at Underbank site

2.1.4 Groundwater

The site of the proposed school is not considered to be at risk of groundwater flooding. It lies above the bank level and peak flood level (see 2.3 below) of the River Clyde. Any groundwater phreatic surface will join up with the river water level, and as such, will not be above the ground level so close to the river.

2.1.5 Tidal

The site is not considered to be at risk from tidal flooding given its raised inland location.

2.2 History of Flooding

South Lanarkshire Council was approached regarding past flood events within Underbank Primary School area. The council have no reported flood records in this area.

2.3 Fluvial Flood Risk

2.3.1 Flooding from River Clyde

In June 2006, Halcrow produced a report on Upper River Clyde Flood Mapping for South Lanarkshire Council. A copy of the report and associated hydraulic model has been provided for use in this Flood Risk Assessment. The model extents cover the River Clyde from the Falls of Clyde, upstream of New Lanark, to Blairston near Hamilton. Inflows to the model were based on peak flow analysis previously carried out by JBA for the River Clyde Flood Management Strategy Broad Scale Model in 2004 for Glasgow City Council. A copy of this report has been requested from GCC but to date, no reply has been received. The Halcrow model was developed in 2 phases: Phase 1 model was based on river cross sections abstracted from LiDAR data and assumed channel dimension. The Phase 2 model was based on detail topographical survey information and is therefore more accurate.

Figure 2.2 below shows an extract of the resulting flood map in the Crossford area. This shows the proposed school site is not at risk of flooding up to the 200 year plus climate change event.

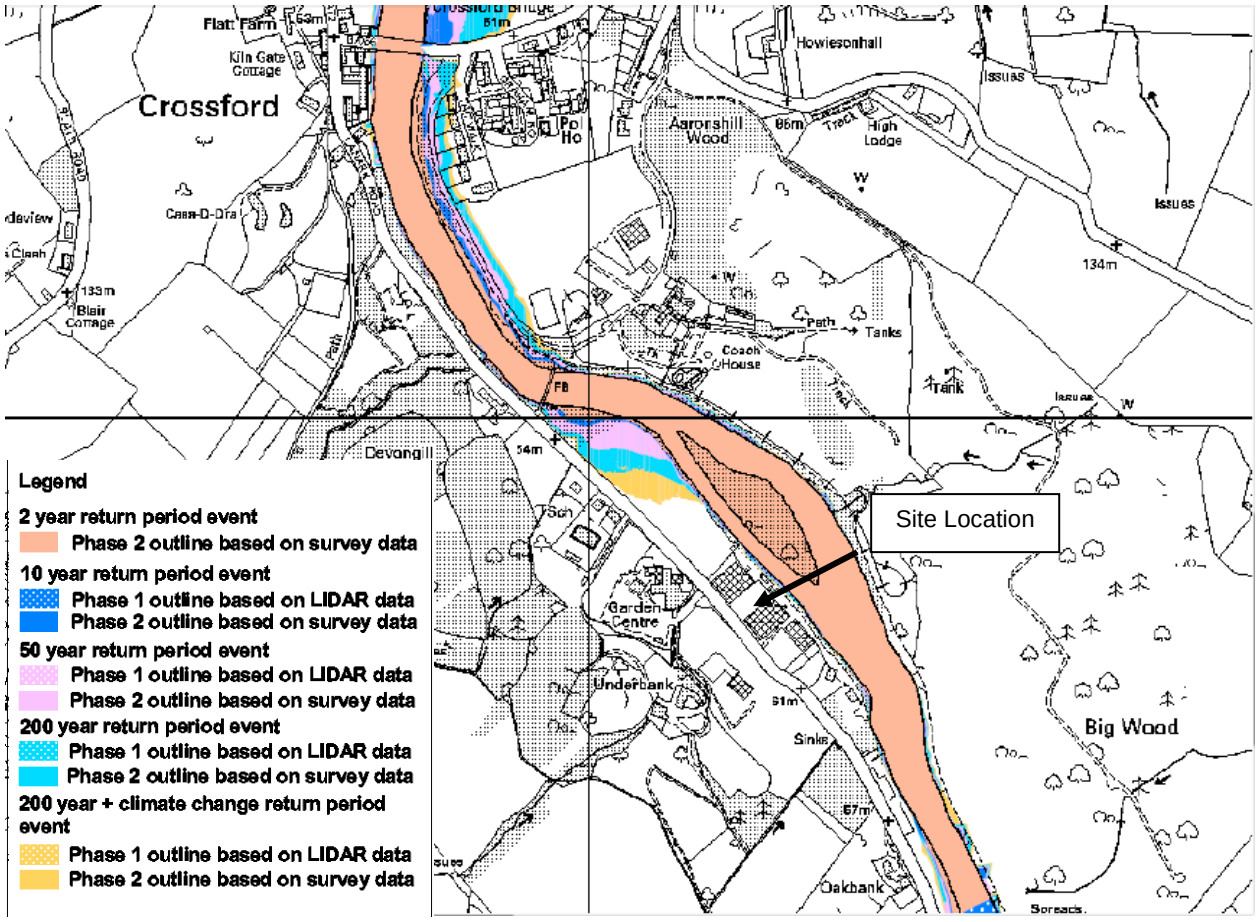

Figure 2.2 – Extract from River Clyde Flood Map (FM06 Phase 2, River Clyde Flood Mapping, Halcrow, 2006)

The site lies between cross sections Cl232 and Cl233 in the 1D ISIS model (Figure 2.3). Peak water levels from the model for the 200 year and 200 year plus climate change are given in the table below and shown in Figures 2.4 and 2.5. The flood events do not result in overbank flow in this location.

Table 2.1: Peak flood levels at the Underbank site

Cross section	200 year event	200 year plus CC event
Cl232 (upstream of site)	53.15 mAOD	53.52 mAOD
Cl233 (downstream of site)	52.33 mAOD	52.75 mAOD

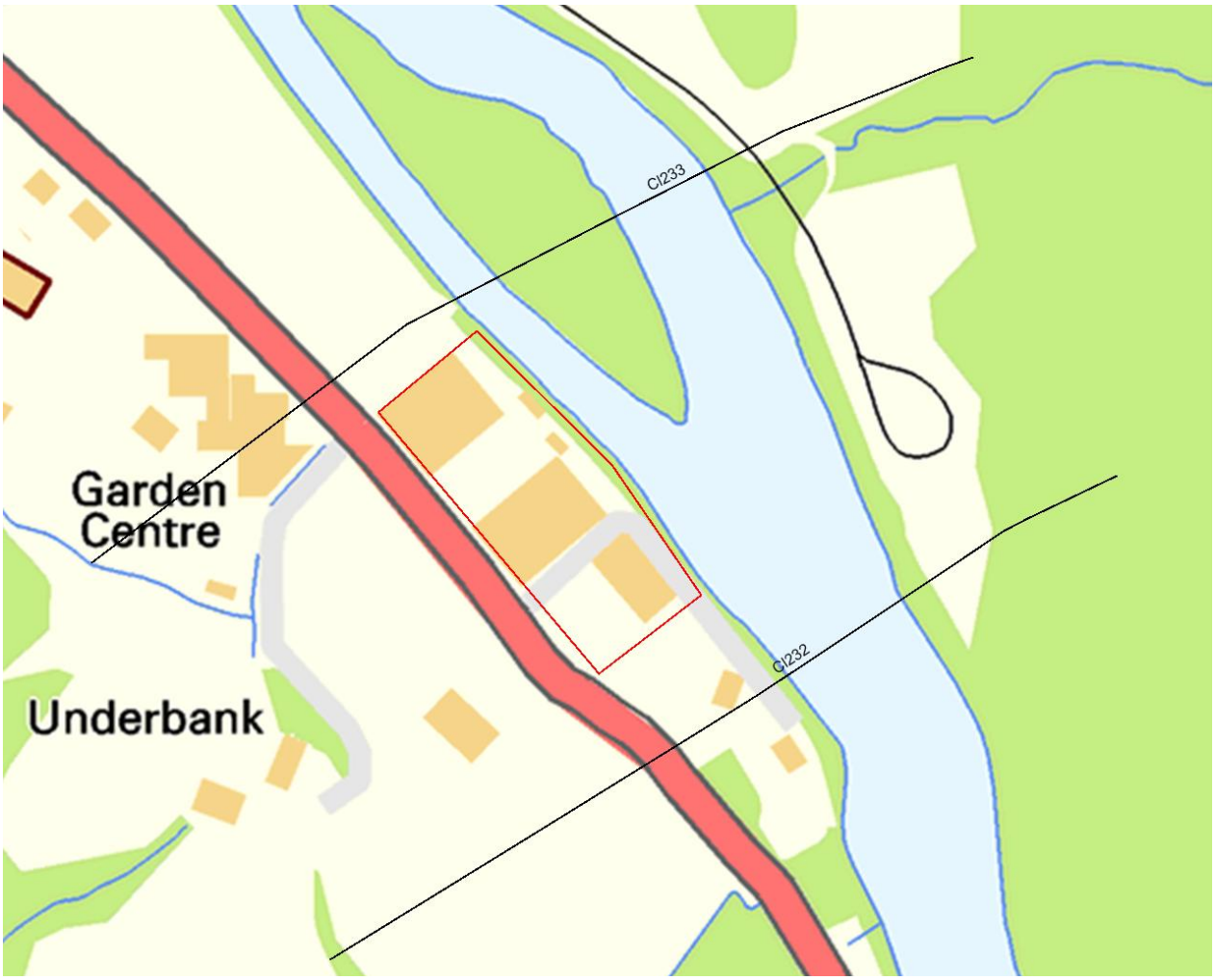

Figure 2.3: Location of ISIS 1D cross sections upstream and downstream of the site

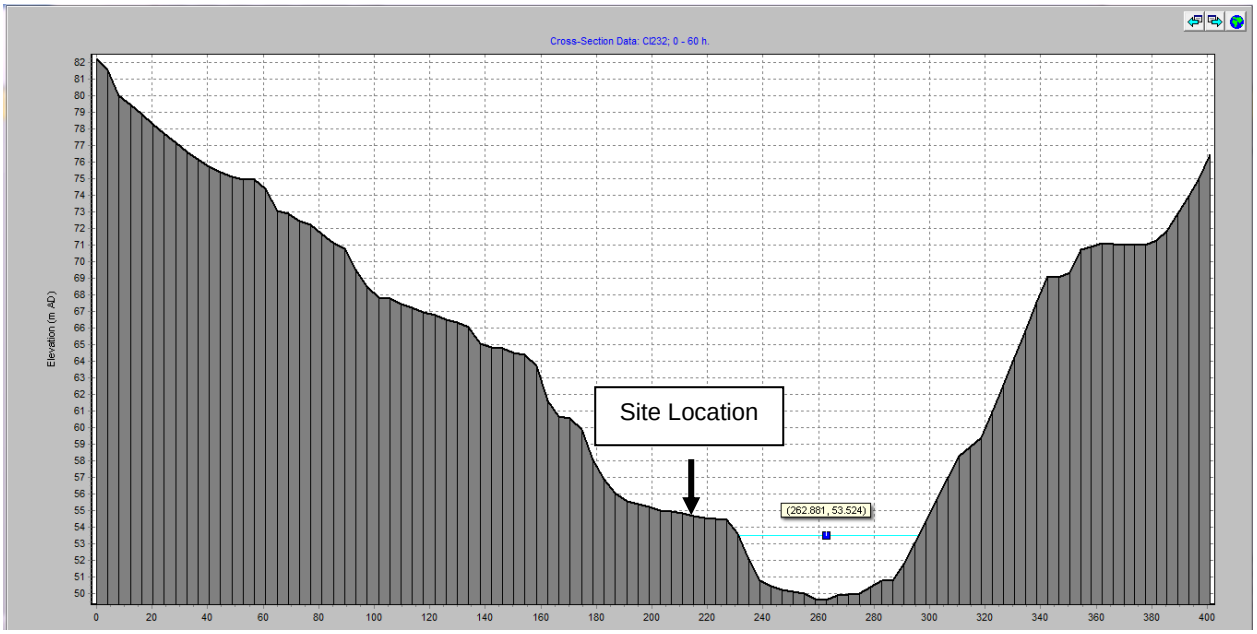

Figure 2.4: Maximum water level at cross section CI232 (upstream of site) for the 200 year + cc event

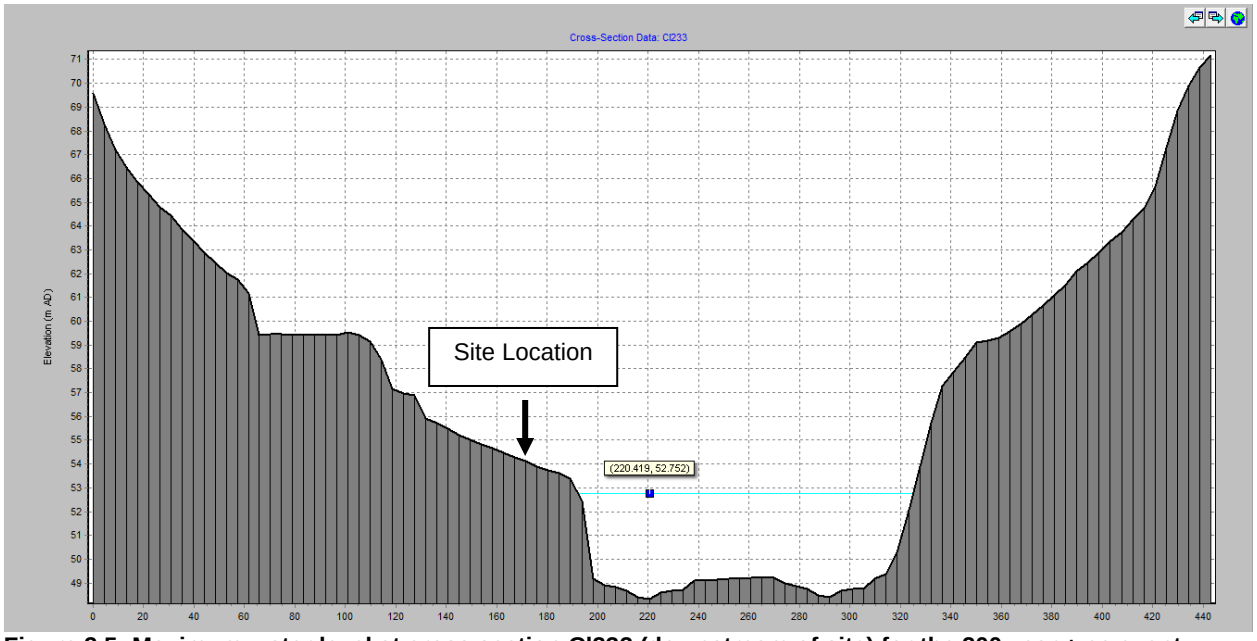

Figure 2.5: Maximum water level at cross section CI233 (downstream of site) for the 200 year + cc event

The site lies just downstream of Hazelbank gauging station on the River Clyde. As the modelling is based on hydrology carried out in 2003/2004, an update to the flow estimates for Hazelbank gauging station was carried out. The FEH statistical method was used, and recent AMAX data for Hazelbank and other Clyde gauging stations was obtained from SEPA. Updated AMAX

data for the remaining gauging stations in the pooling group was also sought from SEPA, however, to date, these have not been provided.

WINFAP-FEH v3 software was used to derive the pooling group for Hazelbank. Based on a target return period of 200 years, and a site record of 59 years, FEH recommends using the pooling method, with a single site check. The resulting growth curves for both the pooling group and single site are shown in Figure 2.6. It can be seen that the single site and the pooling group agree well up to the 200 year growth factor. The final flood frequency figures are shown in Table 2.2 and compared to the flows quoted in the Halcrow report.

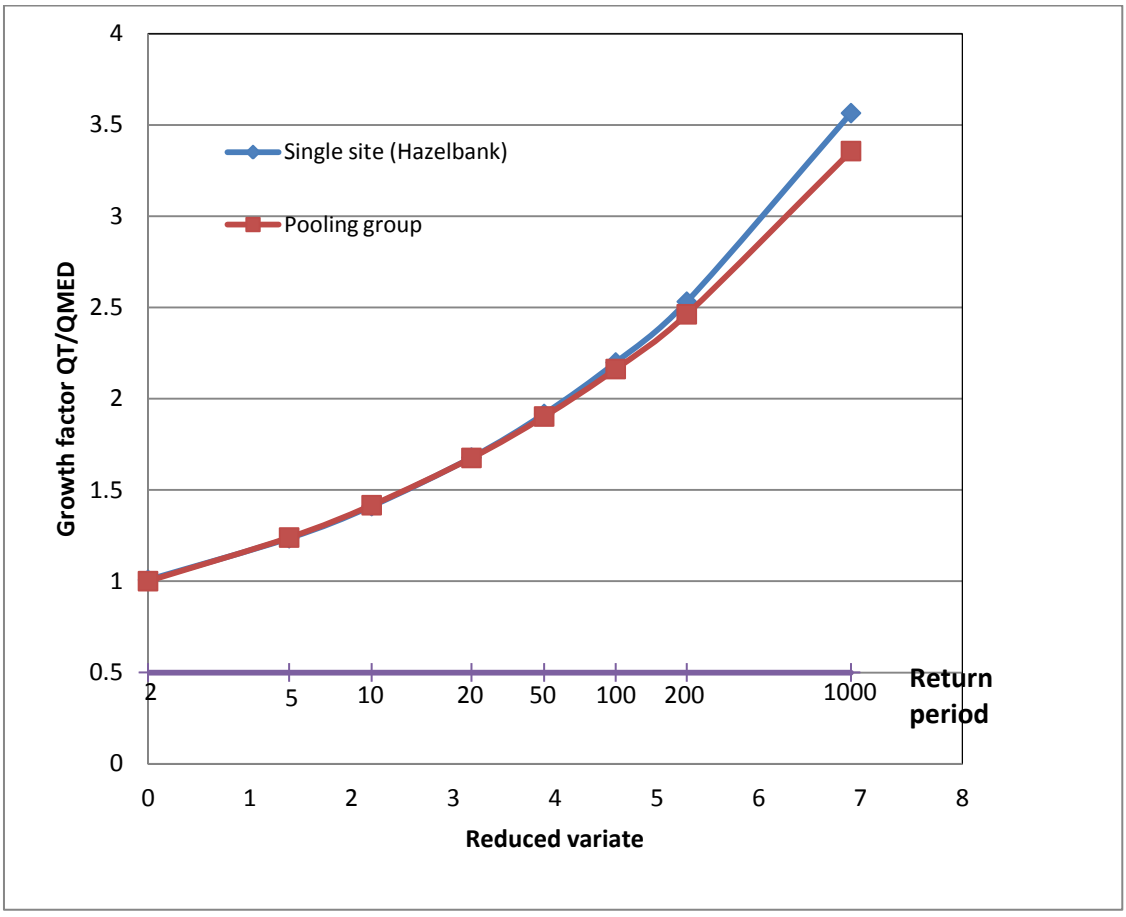

Figure 2.6: Pooling group and single site growth curves

Table 2.2: Updated Flood Frequency Curve for Hazelbank

Return period	Flood Frequency curve (2014)	Flood Frequency curve (2004)
2	277	278
10	392	430
50	527	624
200	682	862
200 +cc	818	1029
1000	929	

It is clear from the table above, that the growth curve derived by JBA in 2003/4 is appreciably steeper and results in a significantly higher flow for the 200 year event. The reason behind this is not known as it has not been possibly to review the JBA report. However, our hydrology check indicates that these flows which have been used in the Halcrow model are extremely conservative, with the 200 year peak flow more than 25% greater than our 2014 estimate, and the 200 year + climate change greater than the 2014 1000 year peak flow estimate.

2.3.2 Flooding from small watercourses to the north and south

Two ditches draining the hillside to the south west of the site are culverted under the A72 road and the remaining land to the River Clyce to the north and south of the site (Figure 2.7). Overbank flow or overtopping of the culvert headwalls have the potential to result in flooding of the proposed site.

Investigation of the landform between the site and the southern ditch indicates higher ground between the location of the road culvert and the site. The road falls to the south east from this high point, meaning any overbank flow or overtopping of the road culvert would flow away from the site down the road.

The location of the culvert on the northern ditch is a few metres north west of the corner of the site, on the other side of the A72. The profile of ground elevations along the road in this location (Figure 2.8) shows the road falls from south east to north west away from the site. Therefore any overbank flow or overtopping of the culvert inlet would be directed away from the site down the road.

2.3.3 Summary of fluvial flood risk

The sections above confirm that the site is not at risk of fluvial flooding from the River Clyde or the two small watercourses to the north and south of the proposed site. Peak water levels in the Clyde for the 200 year + cc event adjacent to the site are 53.52 mAOD at the south east corner and 52.75 mAOD at the north east corner. Finished floor levels should be 1m above these levels to comply with SLC guidance.

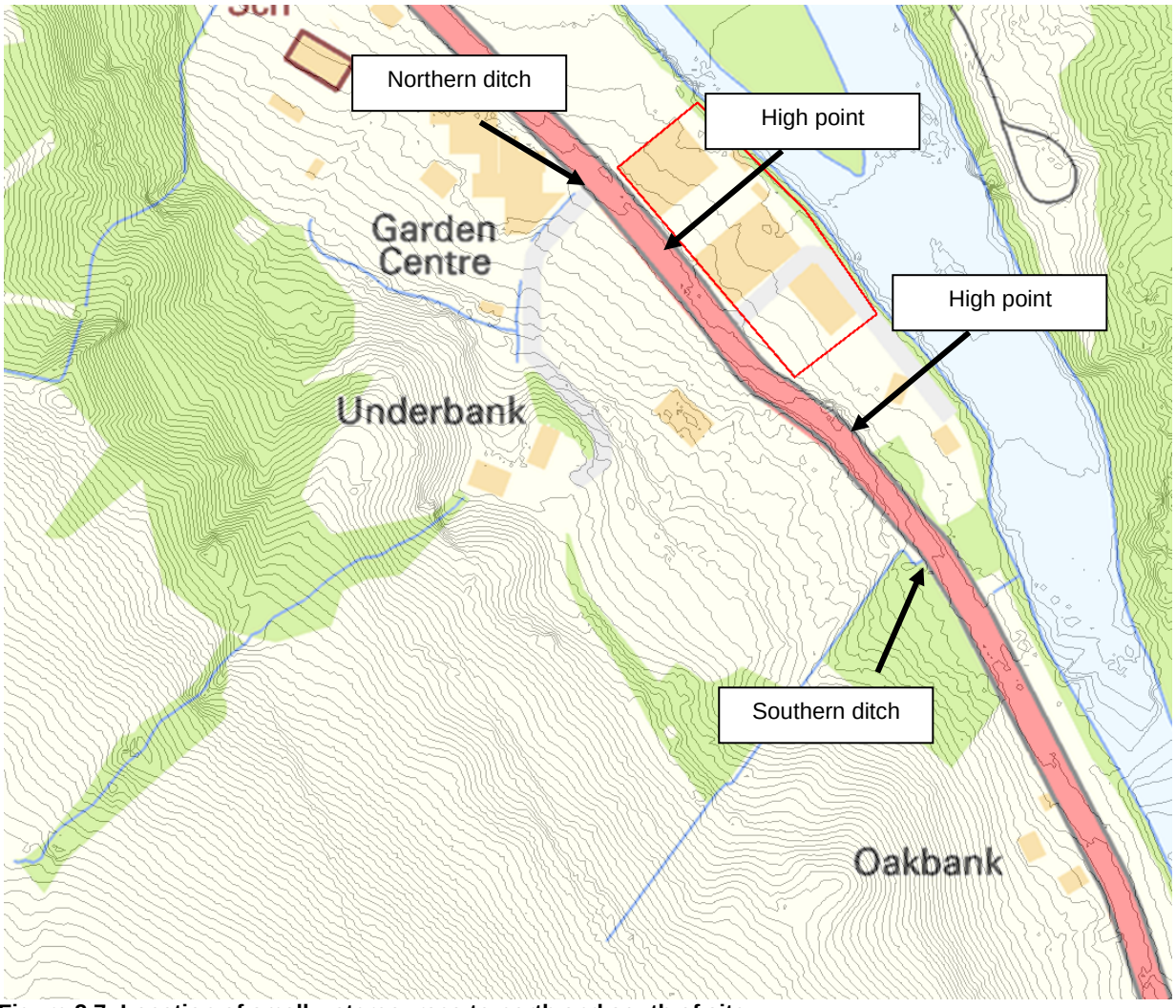

Figure 2.7: Location of small watercourses to north and south of site

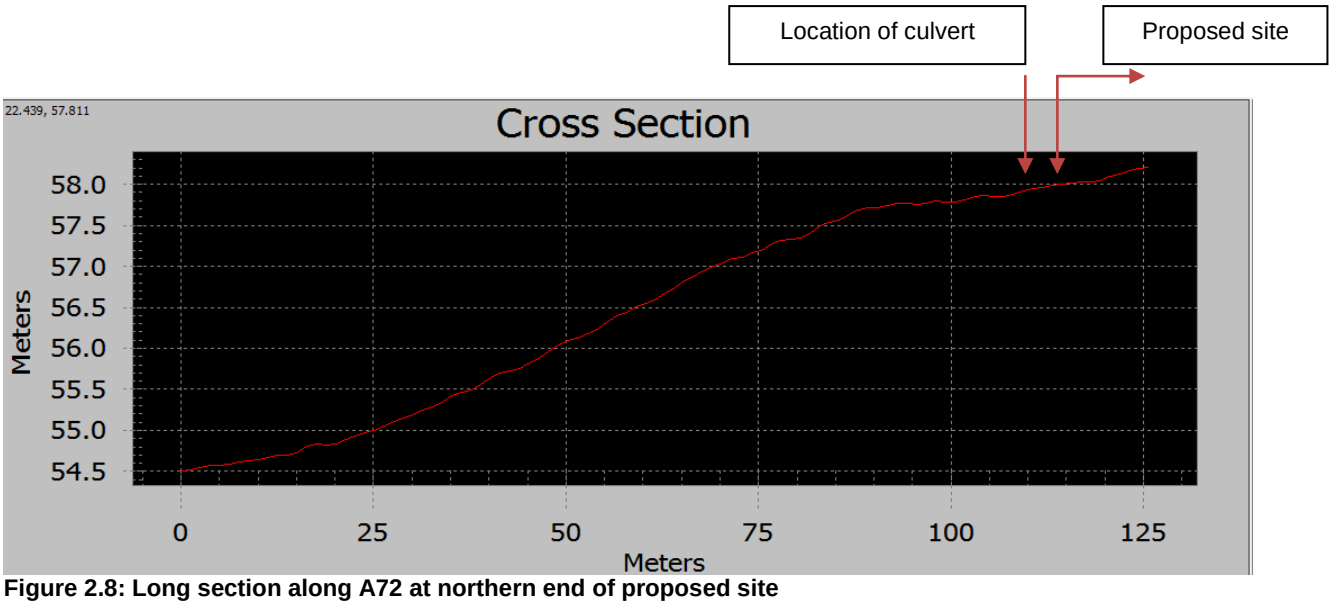

Figure 2.8: Long section along A72 at northern end of proposed site

3 Conclusions and Recommendations

Underbank Primary School is situated between the A72 Lanark Road and the River Clyde, approximately 1km south east of Crossford in South Lanarkshire. The site has been earmarked for redevelopment with a new school building and outdoor facilities being proposed. AECOM Ltd. was commissioned by South Lanarkshire Council to carry out a Flood Risk Assessment in accordance with current guidelines.

A review of the possible sources of flooding indicated the site is not susceptible to flooding from sewer, groundwater or tidal flooding but that the site could be at risk of fluvial flooding from the River Clyde, and two small watercourses to the north and south of the site.

A review of SEPA's flood map shows the proposed Underbank Primary School site is not at risk of fluvial or surface water flooding. A check on the peak flood levels in the Clyde in this location was carried out using Halcrow's 1D ISIS hydraulic model of the Clyde, developed for the Upper River Clyde Flood Mapping Project in 2006. This confirmed that the site is not at risk of fluvial flooding from the River Clyde. Peak water levels in the Clyde for the 200 year + cc event adjacent to the site are 53.52 mAOD at the south east corner and 52.75 mAOD at the north east corner. Finished floor levels should be 1m above these levels to comply with SLC guidance.

Two small watercourses drain the hillside to the south west of the site and are culverted under the A72 and the remaining land to the Clyde discharging to the north and south of the proposed site. A review of the general topography of the area indicated that overbank flow or overtopping of the road culvert inlets for either watercourse would flow along the A72 road and away from the site.

The topography of the site falls fairly uniformly towards the river. On the other side of the road, a steep hillside rises to the south west. Runoff generated on this hillside has the potential to flow over the road and across the site towards the river. However there are currently no low lying areas within the site where surface water or rainfall is likely to pond to any depth. Provided the surface water strategy accounts for runoff from the hillside to the south west, and the proposed landform allows excess surface water exceeding the design capacity to shed from the site, no localised flooding from surface water will occur.

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